THE FIFTH NERVE IN RELATION TO OPHTHALMIC CONDITIONS

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THE FIFTH NERVE IN RELATION TO OPHTHALMIC CONDITIONS.*

By SAMUEL HORTON BROWN, M.D.,

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In presenting this subject, it, perhaps, becomes me, first, to apologize for the trite character of the facts that I shall bring before you, but as the object is merely to renew or awaken interest in those features of ophthalmology that are seldom touched upon, I feel justified in inciting this academic discussion.

When it is considered that all the afferent impulses connected with ocular structures, with the exception of those directly concerned in the special sense of sight, and perhaps trophic impulses, are carried by the fifth nerve through its large branch, the ophthalmic, the necessity of a proper understanding of its distribution becomes at once obvious. Turning for a moment to its anatomical consideration. (Hardesty's description in Morris's Anatomy, 4th edition, 1907), we find that "the sensory root of the trigeminus may be traced through the Gasserian ganglion into the cerebellum and into the terminal nucleus of the pons. After leaving the semilunar (Gasserian) ganglion, in pursuing its course toward central structures, it gives off T-shaped fibers which divide into peripheral and central branches. The central branches divide into ascending and descend-

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ing branches on entering the brain-stem and find their nuclei of termination in a dorsolateral column of gray substance, which consists of the upward continuation of the gelatinous substance of Rolando of the spinal cord. Opposite the entrance of the nerve the column becomes somewhat thickened, constituting the sensory nucleus of the trigeminus, the part below being known as the nucleus of the spinal cord. The branches of the entering fibers bifurcate and terminate about the cells of these nuclei. The descending branches are longer and, passing downward, form the spinal tract of the trigeminus, which may at times be traced as far as the second cervical segment of the spinal cord. The ascending branches are short and terminate, as a rule, in the sensory nuclei."

"The axones from the nucleus of termination are distributed to the nuclei of its motor portion of the same and opposite sides; to the nuclei of the motor cranial nerves, and to the thalamus of the same, and chiefly the opposite side. The sensory nuclei are connected with the somaesthetic area of the cortex by the fibers of the medial lemniscus (fillet) and with the motor nuclei of the other cranial nerves by the medial lemniscus."

While the motor root of the fifth nerve is not directly connected with any ocular functions, it may be well to trace its origin in order to show the close association with the nuclei of other cranial nerves. "The nucleus of origin of the motor root of the trigeminus is composed of two portions. The principal nucleus lies on the dorsomedial side of the sensory nucleus. It gives rise to the greater part of the motor root and its fibers are distributed to the muscles of mastication. Above the principal nucleus and along the line of the locus cœruleus extends the

nucleus of the mesencephalic (descending) root. The cells of this nucleus are thinly scattered as high up as the posterior commissure of the cerebrum and the mesencephalic root arising from them gradually increases as it passes through the encephalon to the superior level of the pons, where it joins the fibers arising in the principal nucleus. The distribution of the fibers of the mesencephalic root is not clearly settled. The motor nuclei of the fifth nerve are connected with the lower part of the somaesthetic area of the cerebral cortex of the opposite side by the geniculate bundle of pyramidal fibers, and they are associated with the sensory nuclei of other cranial nerves by the medial longitudinal fasciculus. Thus it will be readily appreciated how closely related are the central portions of this nerve with the central portions of other cranial nerves, sensory as well as motor, and it is scarcely conceivable, in view of this, that they do not have some common functions at least."

So much for the detail of the central distribution of the nerve. As we all know, the peripheral distribution is through three large branches, the ophthalmic, the maxillary, and the mandibular. The ophthalmic is exclusively sensory, and before it divides into frontal, lacrymal, and nasociliary (nasal) nerves, it receives communicating filaments from the cavernous plexus of the sympathetic and likewise communicates by three branches with the third, fourth, and sixth nerves. This affords a structural explanation of some of the peculiar associated extraocular muscle-palsies and other muscle phenomena, such as twitching of the lids, blepharospasm, etc. Later in its course, through the medium of its nasociliary (ganglion) branch it communicates with the third (oculomotor) nerve and filaments from the cavern-

ous plexus of the sympathetic. The long ciliary nerves are branches of the nasociliary (nasal) branch, while the short ciliary nerves are derived from the ciliary ganglion, which receives its sensory root from the nasociliary (nasal) nerve. Thus it will be seen that sensory impulses except those directly referable to the sense of sight are carried by the fifth nerve, most by the ophthalmic, a few by the maxillary branch. Ocular pain is made possible only through the fifth nerve. The other nerves arising from the fifth nerve are distributed to certain of the muscles of mastication and to the teeth. Through the superficial communication with the facial nerves, pain arising from diseased conditions of the face may be referred to the eye and *vice versa.*

Having disposed of the anatomical conditions, it is necessary, for argument's sake, if for no other, to enumerate the conditions that have been observed to illustrate the relationship assumed at the beginning of this paper. Beginning with the skin of the eyelids, perhaps the most common is herpes zoster ophthalmicus, a clinical variety of ordinary shingles. This follows the peripheral distribution of the fifth nerve and not uncommonly involves the cornea with destructive results. Very occasionally, according to De Schweinitz, atrophy of the optic nerve and paralysis of the oculomotor nerve have followed this affection, showing the trophic influence of the fifth nerve.

Leprosy, an uncommon condition with us, often begins about the eyelids, and is characterized by cellular deposits about and within the nerve, thereby producing anesthetic areas. This anesthesia in leprosy is not confined to the eyelids, but likewise involves the cornea. Anesthetic areas over the dis-

tribution of the ophthalmic nerve in the course of hysteric affections are within the range of possibility, but it is doubtful if such details have been recorded. A peculiar hysteric affection has been reported by C. Markus (*Ophthalmoscope,* January, 1907), which was manifested by tonic contraction of the right frontalis, resulting in a continuous elevation of the right eyebrow. This was not compensatory as is seen in ptosis. There was twitching of the left supercilii and the right pupil was slightly larger than the left. The patient was the subject of almost continuous left-sided headache.

Tonic cramp of the orbicularis (blepharospasm), due to the irritation of foreign bodies in and inflammation of the conjunctiva or cornea is by no means uncommon and owes its production to irritation of the terminal filaments of the fifth nerve. Not only does this reflex action find its expression in this tonic spasm, but pain, photophobia, lacrymation, and redness in anterior ocular structures may be attributed to it. The relation of conjunctival disorders to the fifth nerve is no better illustrated than in the case reported by T. H. Butler (*Ophthalmoscope,* May, 1907), in which mydriasis accompanied conjunctivitis. This was doubtless caused by the reflex arc produced by the communication between the fifth nerve, the sympathetic, and the third nerve. The condition known as snow-blindness, conjunctival asthenopia, etc., is in all probability intensified by some neuropathic factor involving the nerve under consideration, since exposure of other mucous membranes to the same conditions would not be productive of such annoying symptoms. Conjuntivitis has been attributed to teeth disorders by Förster, Kempton, and others in certain cases and relieved by the extraction of the offending teeth.

While most of this apparent relation is speculative, it is possible to point to a tangible connection between the trigeminus and many forms of corneal ulceration. Indolent ulcers, dendritic ulcers, ulceration associated with carious teeth, neuroparalytic ulcers, etc., are acknowledged to be dependent upon the disturbance of the trophic influence of the fifth nerve. In neuroparalytic ulceration we find anesthesia of the cornea as in lepra, herpes corneæ (Horner), and glaucoma. Here the condition is secondary to a severance of the trophic impulses while in other ulcers we find neuralgic pains and increased sensibility dependent upon an increase of sensory impulses. Trophic changes are well illustrated in those corneal conditions associated with Hutchinsonian teeth and rachitic teeth. The influence of the fifth nerve in this connection is obvious.

H. Powers (Trans. Odont. Soc. Great Britain, London 1883-1884, XVI, p. 56) years ago in a detailed study of the relationship existing between the teeth and the eyes called attention to the occurrence not only of corneal ulceration but also glaucomatous symptoms, mydriasis, myosis, paralysis of the extraocular muscles, failure of accommodation, and exophthalmos in the course of dental disease. On the other hand, Stevens, in 1877, reported a case of obstinate toothache relieved by wearing cylindrical lenses, an experience which is by no means novel at this date.

In connection with affections of the iris, it may be assumed that pain is directly due to involvement of the fifth nerve, since it is the sensory nerve of that structure The possibility of the fifth nerve being the intermediate factor in those cases of mumps attended with iritis is worth investigating. True iritis has been shown to have produced neu-

ralgia directly referable to the teeth by Galezowsky (*Journal d'Ophthalmologie,* tome i) and others. Cyclitis secondary to dental disease has been observed by Juler. The ciliary nerves as a factor in the pathogenesis of sympathetic ophthalmia is still entertained by some observers (Schmidt-Rimpler) despite the great vogue the toxin theory is now enjoying.

Glaucoma with its corneal anesthesia, neuralgia, and trophic changes in the optic nerve, certainly is attended with involvement of the fifth nerve, but whether the disturbance of the trigeminus is a primary condition has yet to be proved. Donders inclined to the belief that hypersecretion superinduced by irritation of the fifth nerve, was the cause of the disease. While this theory is no longer entertained, it is interesting to note that the influence of this nerve was the subject of thought at this period. Those cases that have obtained benefit from the Jonnesco operation incline one to regard this older theory of the influence of the trigeminus with some favor in view of very close association of its fibers with those of the sympathetic within the orbit. Badal in 1882 advocated stretching of the nasal nerve for the relief of ciliary pain and the procedure has since been applied to the treatment of glaucoma by Trousseau, Abadie, Lagrange, Ulry, Ginestous, and others. As recently as September, 1906, Villemonte (*Recueil d'Ophthalmologie,* September, 1906) revived the operation making claims for its value in secondary glaucoma, keratoiritis, ulcerous keratitis with secondary glaucoma, chronic glaucoma, and secondary glaucoma occurring in the course of hemorrhagic retinitis and neuroretinitis.

Among the less frequent causes of lenticular

opacities may be mentioned the irritation of the fifth nerve incident to dental disease. Such a case has been recorded by H. Sevill (*Lancet,* 1884, p. 709) although it may be regarded with scepticism. Chorioiditis and vitreous opacities have been observed to follow dental disease by M. Juler. Perhaps the greatest influence of the fifth nerve as regards dental disease is to be observed in those cases in which there is disturbance of the extraocular muscles. Spasm of the eyelids (S. J. Hutchinson, *Medical and Surgical Reporter,* 1885), ptosis, and strabismus (Hancock, *Lancet,* 1859) have been recorded. The accommodation has been reflexly affected by dental disease as is shown by Herman Schmidt's (*Archiv für Ophthalmologie,* XIV) analysis of ninety-two cases of dental disease in which seventy-three instances of deficient accommodation were noted. Reflex blindness has been attributed to the fifth nerve in certain cases associated with dental disease (Brubaker; Allport, *Journal of the American Medical Association,* 1883, p. 637; Dewitt, *American Journal of Natural Sciences,* CX, 1868, p. 382).

While the views of different observers vary greatly as to the real influence of the trigeminus in the cases cited, it remains certain that the close association of the nerve, both centrally and peripherally with the other nerves must of necessity have some close association functionally or pathologically, and it is only with the purpose of reviving an interest in the possibilities, suggested by the anatomy of the nerve, that this essay is written.

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